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(54) A DEVICE FOR PRODUCING A GAS OR VAPOUR STREAM FOR SPRAYING STRIPS COATED IN MOLTEN METAL

(71) We, ITALSIDER S.p.A., of Genoa, Italy, Via Corsica 4, an Italian corporation, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to a device for producing a gas or vapour stream.

Metal strips, for example, steel strips, are often coated with a layer of protecting metal, e.g. zinc, by passing the metal strip through a bath of molten zinc. In order to obtain the most uniform possible coating, a jet of steam or gas under pressure (generally air) is blown through a long and thin nozzle whose length is at least as great as the strip width, on to both surfaces of the metal strip coming out of the bath.

When said nozzle has a constant thickness, the gas or steam pressure at both ends of the nozzle decreases and has a behaviour shown in Figure 1 wherein the ordinates denote the pressure (p) and the abscissae the nozzle length (L).

It is known that when the strip comes out of the molten zinc tank, the coating metal tends to be deposited more on the strip edges than on the central area thereof, as in said two areas of the strip the cooling is quicker.

In order to overcome the first disadvantage (decrease in the jet pressure from the centre towards the ends of the nozzle), a known nozzle has been used which has a larger width at its ends than at its centre, to counteract the pressure decrease shown in Figure 1. Such a device is described in Italian patent no. 896 562.

Later, two shutters were provided at the two ends of the elongated nozzle, the shutters defining exactly the width of the gas or vapour stream as a function of the width of the metal strip to be coated. In this way, the mutual thrust of the two opposed streams in the areas immediately adjacent the strip edges is avoided, so improving the critical conditions of pressure.

The shutters have also the task of removing the noise caused by the opposed jets. The distribution of the pressure along the nozzle after using said shutters is shown in Figure 2 wherein the abscissae denote the nozzle length (L) and the ordinates the pressure (p) along the same.

When comparing the said Figures 1 and 2, the advantages obtained by using the improvements shown in the above patent of the same applicant appear clearly.

However, it was noted that even by using a nozzle giving rise to a pressure diagram of the type shown in Figure 2, it is not possible to overcome the disadvantage of a larger thickness of the coating layer at the two side ends of the metal strip; such disadvantage is due to the higher cooling speed of the coating metal at the edges of the metal strip.

According to the present invention there is provided a device for producing a stream of gas or vapour, comprising a main chamber for receiving the gas or vapour and provided with an elongated nozzle formed by two lips inclined towards each other, a pair of sliding shutters whose transverse profile matches the inner profile of the cross section of the nozzle, for shielding part of the nozzle and so varying the length of the outlet of the nozzle, and a separate chamber adapted to be fed with gas or vapour at a pressure higher than that in the main chamber provided at the edge portion of each of said shutters immediately adjacent the unshielded part of the nozzle outlet and within the main chamber, the separate chambers being so arranged that, in use, streams of gas are formed at the sides of the unshielded part of the nozzle outlet which streams are at a higher pressure

than the stream formed in the middle thereof.

Each separate chamber may slide together with the associated shutter within the main chamber.

The walls of each separate chamber may rest against the inner surfaces of the two lips of the nozzle and may be guided at the rear by a groove provided in the wall of the main chamber.

Each separate chamber may be provided with a feeding conduit which is elongated in a direction parallel to the direction of the nozzle lips.

Each separate chamber-feeding conduit may open into a sliding sleeve which slides within a secondary conduit parallel to the nozzle lips, provided at its bottom with a slot for the passage of the feeding conduit. The secondary conduit may be stationary with respect to the main chamber and be provided with means for feeding the gas or vapour to it, said means passing through the wall of the main chamber.

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings, in which:—

FIGURES 1 and 2 show the behaviour of the pressure along nozzles of the type described in the prior art, when the nozzle width is kept constant and when the nozzle is provided with known improvements;

FIGURE 3 is a diagram similar to the previous ones, though relating to a device for producing a gas or vapour stream in accordance with the invention;

FIGURE 4 is a cross section of the device; and

FIGURE 5 is a perspective view of a shutter and associated chamber for the device shown in Figure 4.

Figure 4 shows a substantially cylindrical manifold 1, fed with gas and/or steam under pressure (usually air under pressure), through feeding conduits (not shown). The manifold 1 has two elongated lips 2 and 3 making an angle of between 30° and 80° with each other, the first of which is rigid, while the second, owing to slot 4, is resilient and through adjusting means (not shown), forms a nozzle whose outlet port has a variable width.

Shutters are arranged at both ends of the manifold 1 to obstruct at least partly the outlet created by the lips 2, 3 and thereby vary its length. One such shutter 5 is shown in Figure 5. A chamber 6 which is fed with gas or vapour through a conduit 7, and which is preferably elongated according to the direction of the manifold axis (Figure 5), is provided behind the nozzle formed by the lips 2 and 3 on each side of the manifold 1. Each shutter 5 is integral with the chamber 6 and closes off the part of the nozzle formed by the lips 2, 3 outside its corresponding chamber 6. A gas or vapour having a higher pressure than the one fed to the central area of manifold 1 flows through the conduit 7 to each chamber 6, whereby the diagram of the pressure along the nozzle is as shown in Figure 3. The chamber 6 constitutes an ejector. In order to arrange that the ejector always corresponds to the end areas of the strip to be coated, the ejector is integrally slidable together with the associated conduit 7 and shutter 5 which latter may be moved manually or automatically through control means sensing continuously the width of the strip to be coated.

To this end, the cross section of the leading wall of the chamber 6 and the cross section of the shutter 5, match the inner profile of the two lips 2, 3 defining the elongated nozzle 18 fed by manifold 1.

Conduit 7 ends in a sleeve 8 sliding inside a conduit 9 provided at the bottom with a slot 20 for the passage of the elongated conduit 7; however, it is clear that any other system may be used for feeding a fluid under pressure into conduit 7 which is movable inside the manifold 1.

For guiding the chamber 6, the forward portion of the wall of chamber 6 rests against the inner surface of the stationary lip 2 on one side and against the inner surface of lip 3 on the other side, while at the rear it is guided in a groove 10 provided within the wall of manifold 1.

The described device is particularly suitable for producing a stream of air which may be blown on to a material, particularly a metal strip coated with molten metal.

WHAT WE CLAIM IS:

1. A device for producing a stream of gas or vapour, comprising a main chamber for receiving the gas or vapour and provided with an elongated nozzle formed by two lips inclined towards each other, a pair of sliding shutters whose transverse profile matches the inner profile of the cross section of the nozzle, for shielding part of the nozzle and so varying the length of the outlet of the nozzle, and a separate chamber adapted to be fed with gas or vapour at a pressure higher than that in the main chamber provided at the edge portion of each of said shutters immediately adjacent the unshielded part of the nozzle outlet and within the main chamber, the separate chambers being so arranged that, in use, streams of gas are formed at the sides of the unshielded part of the nozzle outlet, which streams are at a higher pressure than the stream formed in the middle thereof.

2. A device as claimed in Claim 1, wherein each separate chamber slides

together with the associated shutter within the main chamber and is fed by a conduit with the vapour or gas at a higher pressure.

3. A device as claimed in Claim 2, wherein the wall of each separate chamber has its leading portion adjacent the inner surfaces of the nozzle lips and at the rear is guided by a groove provided in the wall of the main chamber.

4. A device as claimed in Claim 2, wherein the feeding conduit is elongated in a direction parallel to the nozzle lips.

5. A device as claimed in Claim 4, wherein the feeding conduit of each chamber opens into a sleeve sliding within a secondary conduit parallel to the nozzle lips and provided at the bottom with a slot for the passage of the feeding conduit, the secondary conduit being stationary with respect to the main chamber and provided with feeding means for the gas or vapour, said means passing through the wall of the main chamber.

6. A device for producing a stream of gas or vapour substantially as herein described with reference to Figures 3, 4 and 5 of the accompanying drawings.

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2 SHEETS

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.
SHEET 1

FIG.1

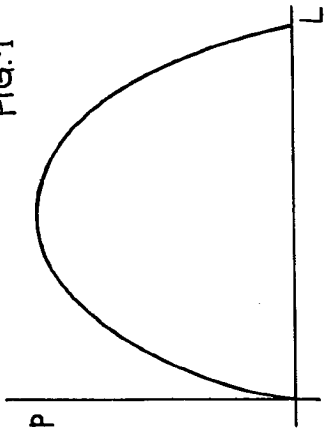

FIG 4

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2 SHEETS

COMPLETE SPECIFICATION

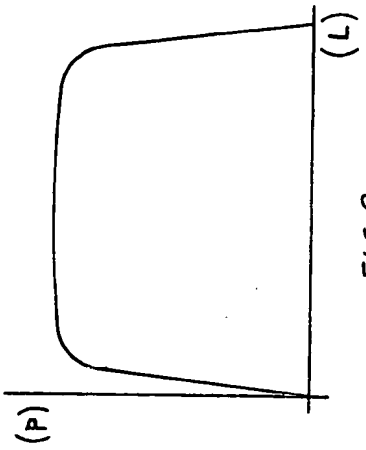

FIG.2

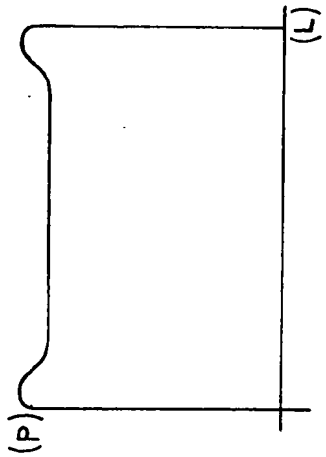

FIG.3

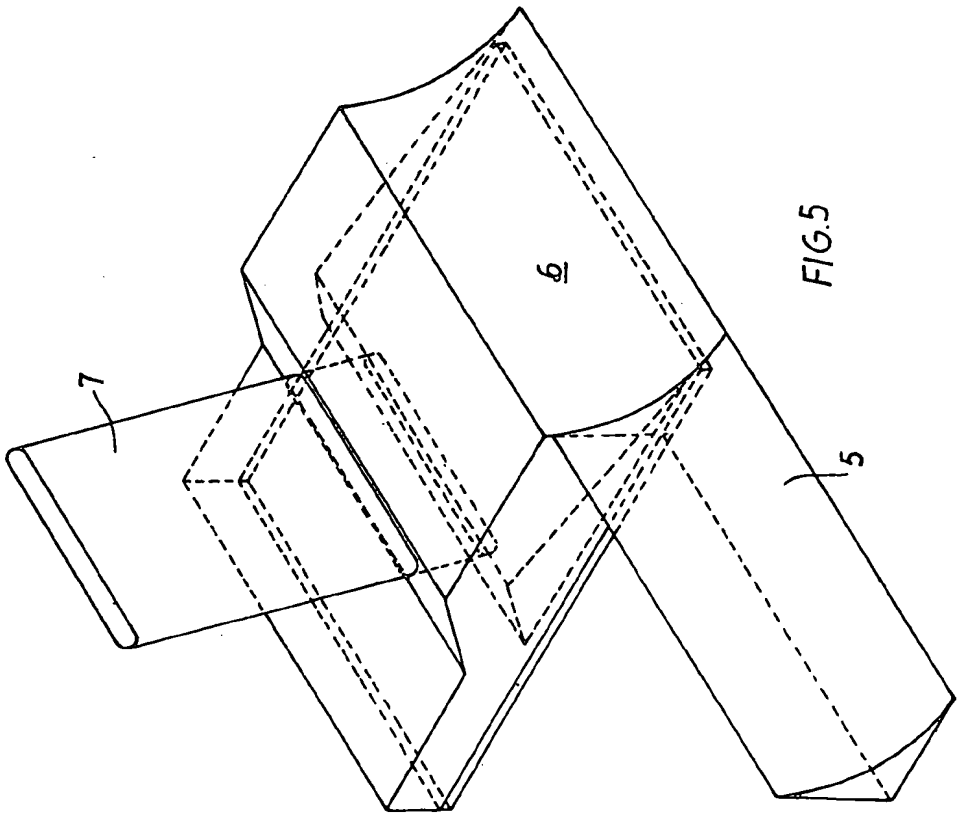

FIG.5